DUST AROUND MIRA VARIABLES. AN ANALYSIS OF IRAS LRS SPECTRA.

S. Slijkhuis
Astronomical Institute, University of Amsterdam,
Roetersstraat 15, 1018 WB Amsterdam, The Netherlands.

The spatial extend and spectral appearance of the thin dust shell around Mira variables is determined largely by the dust absorptivity $Q_{abs}(\lambda)$ and the dust condensation temperature T_{cond}. Various authors have analysed mid-IR spectra to derive $Q_{abs}(\lambda)$ assuming a value of T_{cond}. Onaka et al.(1987, 1988) have derived T_{cond} assuming $Q_{abs}(\lambda)$. They fitted IRAS LRS spectra with a two component dust model: they took the measured $Q_{abs}(\lambda)$ of synthesised amorphous Mg_2SiO_4 (Day 1979) to account for the 10 and 20 μm features, and of Al_2O_3 to account for the 12 μm feature (which dominates the spectra of stars with a symmetrical optical lightcurve, Vardya et al. 1986). In general, their fits are reasonably good, but a large fraction of the spectra is not fitted very well in detail by the laboratory dust emissivities.

In the present work, we try to extract both $Q_{abs}(\lambda)$ and T_{cond} from IRAS LRS spectra. To do this, we make the assumption that the ratio of total power in the 10 μm feature to that in the 20 μm feature should be equal to that measured in other amorphous silicates (e.g. synthesised amorphous Mg_2SiO_4, Day 1979). We find that T_{cond} decreases with decreasing strength of the 10 μm feature, from T_{cond} = 1000 K to T_{cond} = 500 K (estimated error 20%). A similar result was found by Onaka et al. (1987, 1988), but they found lower values of T_{cond}. We cannot determine a value for the Near-IR dust absorptivity. Although this parameter strongly affects the condensation radius, it hardly affects the shape of the LRS spectrum (as long as the optically thin approximation is valid), because it scales the spatial distribution of the dust.

Information on the magnitude of the NIR dust absorptivity may be deduced from the unique carbon star BM Gem. This star has a LRS spectrum with silicate features indicating an inner dust shell temperature of at least 1000 K. However, on the basis of observations in the 1920s-1930s one may infer an inner dust shell radius of at least 6 x 10^{12} m. To have this high temperature at such a large distance, the NIR absorptivity of the dust must be high, compatible with the results found by Jones and Merrill (1976), but less compatible with "astronomical silicate" (Draine and Lee 1984).

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